On the Rates of Interest for the use of Money in Ancient and Modern Times. Part II. By WILLIAM BARWICK HODGE, *Vice-President of the Institute of Actuaries.*

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ON a former occasion I had the honour to lay before the Institute a historical sketch of this subject, from the earliest period of authentic records down to that of the legal establishment of the practice of taking interest, in the reign of Elizabeth.[1]

The facts then adduced showed that very high nominal rates of interest were obtained in the ancient world, and during the middle ages; but such rates are, by no means, to be taken as measures of the profits made upon loans, which must always have been seriously diminished, and often entirely swallowed up, by the exactions and spoliations to which the lender was exposed, and the difficulties he experienced in enforcing his claims, from defective laws, and the prejudices entertained against him by the community.

These prejudices, although varying in degree, have been so constantly manifested in every age, that philosophers have attempted to trace them up to inherent principles in human nature,[2] and they existed during the periods referred to with peculiar intensity.

According to Demosthenes, a money-lender had very little chance of obtaining justice in the Athenian courts of law;[3] and although the same may not have been the case with the ordinary tribunals at Rome, it was nearly so in all questions decided by the popular assemblies.

This state of things was undoubtedly owing, in a considerable degree, to the severity of the laws against debtors. At Athens, before the time of Solon, "an insolvent debtor might be adjudged the slave of his creditor, and not only himself, but his unmarried daughters, and sisters also, whom the law gave him the power of selling."[4]

In the earlier years of Rome, a similar system was in force. A debtor unable to meet his engagements, had no resource but to enter into an arrangement, called a *nexum*, under which, if the debt were not discharged by a certain day, he passed, with all his

[1] *Assurance Mag.* vi., pp. 301–333.

[2] Taylor: *Notes from Life*, p. 26. Bentham's Works, 1843; iii. 17. McCulloch: *Ency. Brit.*, 7th edit.; art., "Interest."

[3] Smith: *Dict. of Antiq.*; art., "Fenus."

[4] Grote: *Hist. Greece* iii. 125.

property, into the possession of his creditor, his wife and children going with him into slavery.[1]

The patricians of Rome were uniformly money-lenders; and the term burghers, applied to them by Niebuhr, is much more descriptive of their real character than their ordinary designation, in the sense attached to it by the moderns. "Every patrician's house," says Dr. Arnold, "was become a private gaol, and a gaol in which the prisoners were kept to hard labour for the gaoler's benefit, and were, at his caprice, loaded with chains and subjected to the lash."[2]

A debtor refusing to enter into a *nexum*, "might, after suffering a cruel imprisonment, be sold as a slave into a foreign land. If there were several creditors, they might hew his body in pieces:" nor could he avail himself of the plea that, on the stage, defeats the malice of Shylock—"for whether a creditor cut off a greater or a smaller piece than in proportion to his debt, he incurred no penalty."[3]

The idea of such a law seems so incredible, that attempts have been made to explain it as only intending a division of the debtor's property among his creditors; but there is no doubt that it existed in the form described, as one of the laws of the twelve tables, which were ratified by the votes of the people.[4] The enforcement of it, in some cases, has been asserted, less positively, indeed; and although that may appear to us too horrible for belief, it would probably be viewed with different eyes by a people so unequalled, among civilised nations, for brutality as the Romans.

The reaction, in favour of the debtor, likely to be produced in the public mind by such severities, may readily be conceived by those familiar with the proceedings of the English courts of law, which, although acting under the mild principles of modern jurisprudence, seem often, in their decisions, to assume that the borrower is necessarily the victim of the lender, and to adopt as a serious truth the doctrine sarcastically laid down by Bentham:[5] "It is an oppression for a man to reclaim his own money; it is none to keep it from him."[6]

[1] Arnold: *Hist. Rome* i. 136. [2] *Ibid.* ii. 21. [3] *Ibid.* i. 137.
[4] *Ibid.* i. 139. [5] *Defence of Usury*, Letter x.
[6] One celebrated English Judge took a very different view of the subject. "In the course of my experience," said Lord Loughborough from the bench, "I have met with many hard-hearted debtors, but very rarely with an unmerciful creditor." English lawyers have invented a peculiar defence, of singular vagueness, to the effect that "advantage had been taken of the borrower's necessities"—as if these were not the only reasons for borrowing, and as if the whole fabric of civil society were not constructed upon the principle, that unless a man can find out some mode of taking advantage of his neighbour's

Under the circumstances described, it is, perhaps, not very surprising that propositions for the entire abolition of debts should have often occurred both among the Greeks and Romans. Many of these we know to have been successful.[1] It can hardly be doubted that others, of which we have no records, were equally so; and the frequency, as well as the danger, of their recurrence, is betrayed by the precaution of the Athenians, who inserted, in the oath taken annually by the Dikasts, or members of the judicial body, a solemn pledge to repudiate any proposal for a depreciation of the money standard, for a redivision of the lands, or for an abrogation of debts.[2]

The direct injustice and spoliation caused by such wholesale bankruptcies, although evils of enormous magnitude, were but a small part of the evils they produced. The disorganization and distrust introduced into the social system—the uncertainty, which made every pecuniary contract a matter of speculation and gambling, until finally settled—the recklessness induced in many, who would be encouraged to incur debts in the hope of such a mode of relief, and the misery that ensued when, as would often be the case, that hope was disappointed—all these circumstances combined must have had a most deteriorating influence upon the happiness and virtue, as well as upon the productive powers, of society. Among the many proofs that may be cited of the superiority of modern over ancient civilisation, perhaps there is nothing more conclusive than the fact, that the possibility of such propositions would never be so much as dreamt of in our own time.

Even the lawless violence of the middle ages produced no such schemes of general confiscation, although the spoliations already described[3] as having been inflicted upon the Jews in England, had their parallel in every portion of the continent where that people had been allowed to establish itself.

"The policy of the kings of France," says Mr. Hallam, "was to employ the Jews to suck up their subjects' money, which they might afterwards express with less odium than direct taxation would incur."[4]

"Philip Augustus released all Christians in his dominions from their debts to the Jews, reserving a fifth part for himself."[4] The

necessities, he has very little chance of providing for his own. What, but necessity, and very hard necessity too, ever induced anyone to avail himself of the services of practitioners in courts of law?

[1] Arnold, i. 147; ii. 126. Suetonius: *Life of Julius Cæsar.* Plutarch: *Life of Solon. Ibid.: Life of Agis.* [2] Grote, iii. 135.

[3] *Assurance Mag.* vi. 321. [4] *History of Europe during the Middle Ages* i. 157.

pious St. Louis, although he took no direct share in such plunder, appears to have had no objection to deriving a sort of reversionary advantage from it, as we find that, for the salvation of his own soul and the souls of his ancestors, he released to all Christians a third part of what was owing by them to Jews.[1]

About half a century after the expulsion of this people from England by Edward I., of which an account has been given,[2] "the Jews throughout the world," according to Froissart,[3] "were arrested, burnt, and their fortunes seized by those lords under whose jurisdiction they had lived"—the only exception, a remarkable one, being in the territories dependent upon the Pope.

These persecutions were in nowise directed to the conversion of unbelievers from an erroneous faith;[4] for, in France, to prevent their adopting such a mode of escaping extortion, a law was passed, by which any Jew who became a Christian forfeited all his goods to the king or to his superior lord.[5]

Even so late as A.D. 1689 (1 William and Mary), it was proposed in the English House of Commons to lay a special tax of £100,000 upon the Jews settled in England; and the idea, at first favourably received, was only abandoned in consequence of their threats to leave the kingdom rather than submit to the exaction.[6]

Another of the modes of plundering creditors, nearly as effectual, and more general than those that have been described, was by the debasement of the coinage. We have already seen that Solon

[1] *History of Europe during the Middle Ages* ii. 401.
[2] *Assurance Mag.* vi. 227. [3] *Chron. Lond.*, 1839, i. 200.
[4] Of all the extraordinary modes adopted by sovereigns for extracting money from the Jews, the most extraordinary is one ascribed to William Rufus, by Holinshed, who relates (*Chron. London*, 1807, ii. 45), that certain Jews of Rouen having embraced Christianity, others of the same nation, resident in that city, offered to give William a sum of money if he would induce the converts to return to their original faith. The king undertook the task, and, calling the men before him, so terrified them by his threats, as to cause divers of them

"To renounce their baptism—
All seals and symbols of redeemed sin."
Othello: act ii., sc. 3.

and again to adopt their former creed.

Another Jew, hearing of William's success, offered him sixty pieces of silver to bring about the same result with the Jew's son who had been converted by a dream. William took the money, but failed in the attempt, although his majesty became so excited by the argument, that he called the young man "a dunghill knave," and threatened "to have his eyes torn out." Thereupon the father demanded back his money; but the king refused to return it, alleging he had done his part in persuading the young man as much as he might. However, the Jew becoming clamorous, the king, "to stop his mouth," gave him back one half the sum, retaining the other half for himself. The coincidence of the thirty pieces of silver is certainly a suspicious circumstance when combined with the hatred towards William felt by the clergy, the only chroniclers of the time; but, even if invented, the story may still be evidence of the manners of the age, and tends to confirm tho opinion already given, that the strong-handed pillage and oppression of the Jews did not commence until about the close of the twelfth century.
[5] Hume: *Hist. Eng.*, chap. xii. [6] Macaulay: *Hist. Eng.* iii. 497.

resorted to this expedient in his celebrated settlement of the affairs of the Athenians[1]—to whose honour it should, however, be remembered that thenceforward they vigilantly guarded the purity of their silver coinage, which was their principal currency,[2] although it appears that a debased coinage of gold was in circulation, for a short time,[3] at Athens.

In most of the other Grecian states the practice of depreciation prevailed; and it is recorded of Dionysius the Elder, that, having borrowed large sums in bullion from the merchants of Syracuse, he repaid them in *tin*, which he caused to be coined and circulated at four times its intrinsic value.[4]

"At Rome," says Gibbon, "the same denomination of money was reduced, in three centuries, from a pound to the weight of half an ounce."[5] The as, originally weighing twelve ounces of copper, contained in the first Punic war (A.U.C. 490, B.C. 264) only two, and in the second (A.U.C. 535, B.C. 219) was diminished to one—a reduction expressly made to defraud the creditors of the republic.[6]

This fact is a sufficient answer to Niebuhr, and his disciple Doctor Arnold, who have endeavoured to show that the diminution in the weight merely kept pace with the increase in the relative value of the metal, and did not, therefore, cause any injustice.[7] Both these learned writers, however, fell into the common error of looking upon money value as an abstract fixed quantity; and they both seem to have been unable to comprehend the principle, that if a man be entitled to receive, at a future day, a given weight of copper, his right ought to be no more affected by any interim variation in its value, because the metal happens to be coined into money, than if his claim were for a given quantity of corn or of any other commodity.

Under the Emperors the silver coinage degenerated more rapidly than the copper money during the republic; and in the reign of Gallienus (A.D. 260) the currency consisted merely of copper pieces plated with silver.[8] It is needless to point out how often the same devices have been resorted to by modern governments — either directly, by debasement of the coinage; or indirectly, by the issue of inconvertible paper-money. The robust English shilling of the reign of Edward III., which contained nearly 250 grains of pure silver, had dwindled, by the time of Elizabeth, to a coin containing less than 86 grains, at which it continued as long as silver remained

[1] *Assurance Mag.* vi. 304. [2] Grote, vol. iii., chap. ix.
[3] Bœckh: *Pub. Eco. of Athens;* Lond. 1842, p. 592. [4] *Ibid.*, p. 591.
[5] *Hist. Dec. and Fall*, chap. xliv. [6] *Esp. des Lois*, liv. 22., chap. xi.
[7] Arnold, ii. 74. Niebuhr: *Hist. Rome* i. 461. [8] *Esp. des Lois*, liv. 22, chap. xiii.

the standard of value. The present French franc approximates closely in weight and value to the livre of the old monarchy, which was the attenuated ghost of the *bonâ fide* pound of silver that formed the basis of the circulation from the time of Charlemagne to that of Philip I. (A.D. 800 to 1100.)

M. Sismondi has observed that, while the monetary system of Europe was abandoned to the depredations of sovereigns, who continually varied the title and weight of coins, the republic of Florence maintained, during the whole period of its existence, the gold florin, that measured all other values in the state, at precisely the same degrees of weight and fineness.[1]

That Athens and Florence, republics whose histories exhibit so many other striking points of resemblance, should each have held out, the one to the ancient, the other to the modern world, a solitary example of integrity in this respect, is certainly a remarkable coincidence, but one which may, perhaps, be explained by the fact, that the leading members of both communities were merchants, whose capital periodically reverted to them in the shape of coined money, which it was, therefore, their interest to maintain at its full standard value.

In reference to the monetary systems of the ancients, it may be worthy of remark, that they appear to have been fully acquainted with the principle upon which paper-money is founded, although they never made use of it in that form—perhaps because the only paper they were acquainted with, that made from the papyrus, was too fragile to bear passing frequently from hand to hand. Timotheus, the son of Conon, to defray the expenses of his expedition to Corcyra, issued copper tokens of a nominal value, at which he undertook ultimately to redeem them.[2] The Byzantines issued thin plates of iron bearing a stamp indicating the value at which they were to pass current,[2] and the Carthaginians circulated leather money,[2] the use of which has been attributed to the Greeks and Romans, but erroneously, according to Bœckh.[3]

As no specimens of the currencies above mentioned have come down to us, we are unable to determine their precise nature; but it is clear, that to have maintained them in circulation as representatives of value, they must have been made convertible, either immediately or prospectively, into the precious metals.

Very curious and interesting light has been thrown upon this subject by the recent discoveries of an English traveller, which have not only shown that a complete system of artificial currency was in

[1] Cab. Cyc.: *Hist. Ital. Rep.*, p. 85. [2] Bœckh, p. 294. [3] *Ibid.* p. 596.

use among the Assyrians, but have enabled the inhabitants of London, by a visit to the British Museum, to inspect, in actual corporeal existence, bank notes issued by Nebuchadnezzar himself.

Mr. Loftus, the traveller alluded to, while engaged in superintending excavations in a city of Mesopotamia called Warka, the ancient Erech, supposed to be the Ur of the Chaldees, found a large collection of tablets of baked clay, carefully arranged, each of which was covered with minute characters. These he subsequently submitted to Sir Henry Rawlinson, who, upon deciphering them, pronounced them to be of two kinds: one resembling our commercial notes of hand—"the tenour of the legends being apparently an acknowledgment of liability by private parties for certain amounts of gold and silver. The more formal documents, however, seemed to be *notes issued by the Government* for the convenience of circulation, representing a certain value, which was always expressed in measures of weight, of gold or silver, and redeemable on presentation at the royal treasury." The date of issue, specifying the day, month, and year of the king's reign, is given in each document; and Sir Henry succeeded in finding the names of Nabopolassor, Nabokodrossor, Nabonidus, Cyrus, and Cambyses (ranging from 626 to 522 B.C.).[1]

Mr. Loftus has penetrated into the Lombard or Threadneedle Street of the City, and found the stores of one of its bankers exactly in the state they had been left twenty-three centuries before.

The Chinese too, although they have no circulation of the kind at present, made use of paper-money some centuries before it was adopted in Europe. Its introduction among them, as in our own country, arose from the financial embarrassments consequent upon a revolution, and an alteration in the succession to the crown. Hong-vou, the first Emperor of the Ming dynasty, who reigned about the close of the fourteenth century, endeavoured to obviate a great scarcity of money that occurred in his time, by issuing government notes. A fac simile of one is given by Du Halde,[2] together with translations of the inscriptions thereon. It bears the imperial titles and seal, with the legend *y Konan*, signifying that it represents a thousand deniers, equivalent to a tael, or one ounce of silver. There is, likewise, a denunciation of the penalty of death against forgers, and the offer of a reward to those who may apprehend them; but there is not upon the face of the note any provision for the conversion of it into bullion. This document must have been

[1] *Travels in Chaldea;* Lond., Nisbet, 1857; p. 221.
[2] *Description de la Chine;* La Haye, 1736; ii. 201.

more than 300 years in existence when copied by Du Halde; and, as it was apparently uninjured, could not have been in circulation for the whole, or even any large portion, of that time. Its preservation, with that of many others of the same kind, was due to a curious superstition among the Chinese, who believed that a house might be secured from every kind of misfortune by having one of these notes suspended from the main beam of the roof[1]—a notion that must have been very profitable to the Government if it became popular when a large amount was in circulation.[2]

Until the termination of the sixteenth century, the prejudices of the moderns against money-lenders, envenomed as they were by the bitterness of religious fanaticism, were infinitely stronger than those of the ancients. The early Christian Fathers adopted, as universal injunctions, the texts of Scripture already quoted, forbidding the Jews to practice usury except with strangers; and this interpretation was strenuously adhered to, not only by the whole Romish Church, but even by many Protestants, long after the right of private judgment had been vindicated by the Reformation. In *A Small Treatise against Usury*, by Sir Thomas Culpeper, reprinted by Sir Josiah Child (A.D. 1693), it is boasted, that before the 37th Henry VIII. "usurers were in the case of excommunicate persons; they could make no wills, nor were allowed Christian burial."

So strong was the feeling of the Papal authorities on the subject, that the establishment of *Monti di Pietà* in Italy was vehemently resisted and long delayed, on the ground that they were illegal and usurious, although it was proposed that small loans should be issued gratuitously, while for larger sums no higher rate should be charged than might be necessary to meet the expenses of the establishment.[3]

The principles alluded to continued to be insisted upon, although it was repeatedly pointed out that the enactments of the Jewish lawgivers as to usury were entirely of a local and temporary character, and, even if they had been more general, that the expression

[1] *Description de la Chine* ii. 201.

[2] According to a story current in Ireland, the insurgents, during the last great rebellion in that country, indulged their vindictive feelings against a family peculiarly obnoxious to them, by burning, whenever they fell into their hands, the notes of a bank in which the names of some members of the family appeared as the principal partners.

[3] *Statistical Journal* iv. 348. The first *Monte di Pietà* was established A.D. 1491, at Padua, by Bernardino di Feltri, a monk of that city. In Italy, the offerings of the faithful deposited in the churches for the benefit of the poor were called *monti* (heaps, or collections), and de Feltri named the subscriptions he obtained for the object he had in view "*Il Monte di Pietà*,"—the compassionate collection. From this the French adopted the expression, *Mont de Piété*, the literal meaning of which is very different.

addressed to the unprofitable servant in the parable, "Wherefore then gavest thou not my money into the bank, that at my coming I might have received mine own with usury?"[1] would be conclusive against them, as it is impossible the man could have been reproached for omitting to do an act in its nature criminal.

It is needless to go into a refutation of doctrines so unanimously condemned by the opinions and practice of mankind—doctrines not really founded upon any scriptural authority, but upon a dogma attributed to Aristotle: "That money is naturally barren, and to make it breed money is preposterous, and a perversion of the end of its institution, which was only to serve the purposes of exchange and not of increase."[2] "This passage," says Blackstone, "is suspected to be spurious.[2]

Certainly, nothing but the reputation of its supposed author could have induced Bentham to take the trouble of confuting such a contemptible conceit;[3] and it is a memorable example of human absurdity, that texts of Scripture should have been perverted, and the lessons of the Divine founder of Christianity set at nought, to maintain the authority of a heathen philosopher in respect of an opinion, utterly ridiculous in itself, which it is doubtful that he ever entertained.

Doctor Paris, in his life of Sir Humphrey Davy, has suggested as a curious subject of inquiry, the influence in retarding the discovery of sound principles in natural philosophy of the celebrated phrase derived from the doctrines of Aristotle, that "nature abhors a vacuum." A similar inquiry might well be undertaken to determine the effect of the pseudo-Aristotlean theory, that money is naturally barren, upon economical science, the first step in which was the recognition of the principle of allowing interest upon loans, just as the first step in natural philosophy was a correct appreciation of atmospheric phenomena.

There can be no doubt the results of such investigations would afford striking evidence of the evils caused by a blind deference to authority, by proving to what an enormous extent the opinions, real or supposed, of a single individual had obstructed the progress of two sciences to which the civilised portion of mankind is indebted principally, if not wholly, for the astonishing advances it has made in recent ages.

The supposed doctrine of Aristotle, although it had no influence whatever upon the practice of the Greeks, held, for centuries after

[1] *St. Luke* xix. 23. [2] Blackstone's *Commentaries* ii. 453.
[3] *Defence of Usury*, Letter x.

the Christian era, undisputed sway over the opinions of churchmen and lawyers. Long after the passing of the 13th Elizabeth, two English Judges are reported to have declared from the bench—"*Que à cette jour use de money n'est bon consideration quia encounter ley natural, car comme Herle dit, est monstrous que argent producera argent, ed ad ettre defame par touts estatuts comme horrible damnable.*"[1]

Thomas Wilson, a Doctor of Civil Law, and a Master of the Court of Requests, published in 1554, *A Discourse upon Usurie, by way of Dialogue and Oracions,*" printed in black letter, in which he makes the principal interlocutor say, "Assuredlie the usurer is none other than a theefe and murtherer of his even Christian, and as well worthy to die the death as any other offender whatsoever."[2] This writer contended that no rate of interest, however small, was permissible, saying, "I, for my part, would not take a pennie more than I did lend, for all the goods in the world. For I know there is no meane in this vice more than there is in murther or theft."[3] Again, "And yet he that proveth you an usurer maketh you ten times worse than a theefe, and as evill as a murtherer; yea, this will I saie, that it were better to winke at a hundred pickpurses in London than to suffer the wringing of twentie known usurers."[4]

Doctor Wilson, who is described as a man of great learning and piety, declared it as his opinion, in a debate in the House of Commons, that taking interest for money ought to be adjudged a felony;[5] and his extravagant notions were shared by many, particularly among divines, whose zeal is represented to have been stimulated by the fact that the usurer's profits paid no tithes.

The state of public opinion is indicated by Shakespeare, who puts into the mouth of Antonio a boast that would sound strangely from a modern merchant—

> "Shylock, albeit I neither lend nor borrow,
> By taking nor by giving of excess."
> *Merchant of Venice*, act i., sc. 3.

The picture presented in this play, which represents a man as worthy to be cuffed and spit upon for receiving interest upon his money, while a court of law coolly sits down to deliberate whether it shall authorize him to mangle a fellow-creature, in exacting a penalty for the non-payment of a debt, is, although exaggerated as to the circumstances, in strict conformity with the principles of the

[1] Kelly: *On the Usury Laws;* Lond. 1835; p. 26. [2] *Discourse*, &c., p. 28.
[3] *Ib.*, p. 35. [4] *Ib.*, p. 74. [5] Kelly, p. 219.

canon law upon the subject of loans; and, amid the incessant attempts to extract a profound meaning from every production of a man of genius, it is surprising no one has suggested that Shakespeare was deeply versed in political economy, and endeavoured to overthrow, by satire, errors apparently impregnable to the ordinary assaults of common sense.[1]

The discredit attached to the practice of money-lending naturally threw it into the hands of persons having little regard for public opinion, and whose conduct too frequently confirmed the popular prejudice against them. As a matter of course, they were frequent subjects of satire with the dramatists; who, however, did not show much discrimination in their delineations, generally representing the money-lender as a stupid gull, whose unreasoning covetousness made him the victim of the most clumsy contrivances, and would have prevented his being a money-lender long, by speedily leaving him without any money to lend.[2]

In the *Curiosities of Literature*, D'Israeli, who drew from facts, has devoted an article to the usurers of the seventeenth century, containing a great deal of curious and amusing information.

The most extraordinary thing connected with the outcry against

[1] The following epitaph upon John Combe, a usurer of Stratford-on-Avon, and an intimate friend of Shakespeare, was long attributed to the poet; but erroneously, as subsequent inquiries have shown—

"Ten in a hundred lies here ingrav'd,
'Tis a hundred to ten his soul is not sav'd.
If any one ask, Who lies in this tomb?
Oh, ho! quoth the devil, 'tis my John a Combe."

[2] *See* the character delineated in the "Hog that hath lost his Pearl."—Dodsley's *Old Plays*, vol. x. A professional writer on the usury laws (Kelly, p. 115), has pointed out that most of the pretences of Harpagon in *L'Avare*, and of Moses in the *School for Scandal*, might have been copied from the writings of St. Basil, published in the third century. If all the works of imagination produced since the creation of the world could be analysed and compared, the amount of original invention contained in them would probably be found exceedingly small. Dr. Johnson said, truly, in speaking of Homer, "that nation after nation, and century after century, had been able to do little more than transpose his incidents, new name his characters, and paraphrase his sentiments."—*Preface to Shakespeare.* The usurer was attacked without mercy in the popular ballads of the time. In one entitled "When this old cap was new," the following stanza occurs:—

"Then bribery was unborn,
No simony man did use;
Christians did usury scorn,
Devised among the Jews."

And Gernutus the Jew, a money-lender, is thus described in the ballad of that name—one of the many versions of the story of Shylock (*See* Percy's *Reliques of Ancient English Poetry*):—

"His life was like a barrow hogge,
That liveth many a day;
Yet never once doth any good,
Until men will him slay."

usury, is, that it was founded upon a distinction so nice, as absolutely to defy precise definition.

To lend money for gain was, as we have seen, denounced as a crime in the last degree horrible and atrocious; but the most violent advocates of that opinion admitted that the borrower was bound to compensate the lender, not only for any loss arising from the non-return of his money at the time agreed upon, but for any loss he might have incurred, as well as for any profit he might have relinquished in making the loan. The first and second instances came within the case of *damnum emergens*, and the last within that of *lucrum cessans;* in both of which it was admitted by the canon law that the borrrower was bound to indemnify the lender. Thus, if the latter were about to purchase an estate, but refrained from doing so in order to make the loan, he might lawfully receive from the borrower an equivalent for the rents of the property, a principle that left innumerable openings for evasions, although it was held that the gain given up by the lender must be something that was certain before he agreed to make the loan, and not a mere probability, yet even an uncertain profit might be estimated and adjudged, *lucrum cessans*, by a proper arbiter.[1] To covenant for the payment of damages, interest, and expenses, in case the loan should not be repaid at the stated time, was common, and perfectly lawful.[2]

The penalties of the Statute 11th Henry VII. were directed only against persons taking "any thing more besides or above the money lent by way of contract or covenant at the time of the same lone; *saving lawfull penalties* for non-payment of the same money lent;"[3] and Dr. Wilson, the writer already quoted, expressly says, "I do not denie that they who keep your money from you longer than by covenant was agreed are to answer for it, and in al lawe and reason must paie your damages and interest for your money for so long a time holden from you against your will, for herein he doth you apparent wrong, and covenant was there none for gaine to be reaped upon the principall, so this is no usurie," "damages may justlie be awarded to you after ten or twelve in the hundred, and no usurie committed."[4]

This doctrine led readily to another mode of evasion. If a loan were agreed upon for six months, at the rate of 10 per cent. per annum, the money was lent nominally for three months

[1] *See* some luminous remarks upon the subject of these distinctions by Professor De Morgan (*Companion to Almanack*, 1851, pp. 15 to 18).

[2] Macpherson: *Hist. Comm.* i., pp. 427, 509, 555.

[3] *Statutes of the Realm* ii. 574.

[4] *Discourse*, &c., p. 60.

free of charge, with a proviso that if not paid in that time it should bear interest at 20 per cent., which, of course, would entitle the lender at the end of six months to his principal with interest, for the whole term, at the rate originally intended. It is said the Jews were very merry, as well they might be, when they heard of the Christians' method of avoiding usury,[1] which was, however, only practicable with persons on whom a certain amount of reliance could be placed, because the borrower, by returning the loan at the end of the nominal period, might, for that term, escape the payment of interest altogether.

A more certain method was termed *dry "exchange,"* by which the borrower drew a bill of exchange upon a fictitious personage at Amsterdam, or any foreign town. At maturity the bill was returned protested, the borrower being charged with re-exchange and incidental expenses; and, in this way, 20 or 30 per cent. was often made, the bill never having been out of the country.[2]

The most common form of evasion, however, was one that subsisted to nearly the present time—namely, that of furnishing the borrower, instead of money, with goods, which were resold to the lender, through his agents, at prices much below those he had charged for them.

Elaborate provision was made in the 11th Henry VII.[3] against this device, represented in the preamble of the 13th Elizabeth[4] to have been "well repressed" by the Statute 37 Henry VIII., which allowed of interest at 10 per cent. per annum; but as having "more exceedingly abounded" since the repeal of that Act by the 5 & 6 Edward VI., which forbade the taking of any interest whatever.

Dr. Wilson gives the following account of the practice as carried on in his day:—"I have neede of money and deal with a broker, he answereth me that he cannot helpe me with money, but if I list to have wares I shall speede. Well, my necesitie is great, he bringeth me blotting-paper, packthread, fustians, chamlets, haukes, bels and hoodes, or I know not what: I desire him to sell for mine advantage, asking him what he thinketh will be my losse? he answereth, not above twelve pounds in the hundred. When I come to reckon I find I doe lose more than twentie in the hundred: this is called a double stoccado, or the double stab."[5] The Clown in *Measure for Measure*,[6] while enumerating the inmates of the gaol, says, "First here 's young Master Rash, he's in

[1] Kelly, p. 11. [2] *Ibid.*, p. 18. [3] *Statutes of the Realm* ii. 574.
[4] *Ibid.* iv. 542. [5] *Discourse*, &c., p. 100. [6] Act iv., sc. 3.

for a commodity of brown paper and old ginger, ninescore and seventeen pounds, for which he made five marks ready money."

Professor De Morgan remarks, that almost all the books of arithmetic of the sixteenth century contain a class of questions which seem to indicate a method employed among merchants of evading direct usury. "A man lends his friend £145 for sixteen months; when the latter is asked to return the favour, he can only command £94. How long ought he to lend this last sum in requital of his own obligation?" [1]

Doctor Wilson distinctly denounces this practice as usurious;[2] and, according to the same writer, the following were likewise cases of usury:—

"If a man lend money upon promise of a satin gown for his wife, or of an ambling gelding for his or her riding, or hoping assuredlie to have some thankful recompense—which is *mentalis usura*, or usury of the mind—or to get an office, or to his tenants upon the condition that they shall plough his land, he not paying them for their labour; or if he buy goods upon credit and deduct discount for prompt payment, or buy a debt for less than is due thereon."[3]

Many other forms of evasion are cited, such as lending in fictitious names, and men supplying their wives with money to lend at interest.[4]

In addition to the cases of "emergent damage" and "cessation of profit," it was universally admitted that interest might lawfully be charged when there was risk of losing the principal lent. As the uncertainty of human affairs is such that a lender must always incur a possibility of loss, either from the insolvency of his debtor or the failure of his security, this principle carried out to its full extent would have justified the taking of interest in all cases.

The English law, however, always rigidly excluded from consideration such contingencies as these, insisting that the risk to the principal must arise out of the conditions of the contract, as in

[1] *Companion to Almanack*, 1851. The learned Professor quotes (p. 17), the following poetical opening of *Webster's Tables*, published A.D. 1605, which shows how carefully the arithmetician, in giving rules for the calculation of interest, guarded himself against advocating the practice of taking it:—

"And though in interest thus thou deal'st thou not approv'st at all
Of vsurie, which may (for thee) beneath just censure fall.
Thou not conclud'st such contracts made are lawfull, yea or no,
But truly to performe the same (by parties both) dost shew
In only this thou art a guide; but else, as is most fit,
Thou to the guidance leavest all of grace and Holy Writ.

[2] *Discourse*, &c., p. 104. [3] *Ibid.*, pp. 104–106. [4] *Ibid.*, p. 110.

loans upon bottomry, or annuity, in which the claim is extinguished by the loss of the ship, or the death of the annuitant. The same views appear to have characterized all the earlier writings and legislation upon the subject, but in later times the casuists seized eagerly upon the excuse of the risk of loss from the failure of the debtor, as it enabled them to yield to the growing necessities of society and sanction the practice of lending upon interest, without abandoning their darling theory of the natural barrenness of money.

A learned writer, whom I have often had occasion to quote, has happily exposed the inconsistency of those who maintained a doctrine that made the poverty of the debtor, and the consequent danger of his failing in his engagement, a reason for charging him a heavy interest, while they professed at the same time to adhere strictly to the Mosaic texts, which were expressly directed against lending upon usury to the poor.[1]

A complete idea of the mode in which this question was treated by the canonists, and indeed of their whole theory upon the subject of usury, may be obtained from a case decided at Rome arising out of the following circumstances.

It seems that the legal rate of interest in China about the middle of the sixteenth century was 30 per cent. per annum, and the Roman Catholic missionaries in that country, sorely perplexed between their desire for investments on such profitable terms and their dread of incurring the imputation of usury, endeavoured to satisfy their consciences by submitting a question to the Pope, Innocent X., who ordered the Sacred Congregation de Propaganda Fide to be convened, for the purpose of considering and determining it (A.D. 1645).

THE CASE.

"In the Kingdom of China it is settled by law that thirty per cent. may be taken for money lent, without any regard of '*ceasing lucre*' or '*emerging damage*' to him that lends. 'Tis demanded, whether it be lawful to receive the said thirty per cent., as establish'd by law of the kingdom, tho' no cessation of lucre intervene or emergent damage? The motive for doubting is the danger which occurs, either because he that received the principal may be absent or fly, or that he's backward in paying, or that the creditor may be forced to go to law, or the like."

THE ANSWER OF THE SACRED CONGREGATION.

"The Congregation judges that for money immediately and purely as lent, nothing is to be taken above the principal; but if anything be received by reason of a *probably intervening* danger, as in the case, they are not to

[1] De Morgan: *Companion to Almanack*, 1851.

be disquieted, so that regard be had to the quality and probability of the danger, and proportion be kept between danger and interest."[1]

It seems wonderful that any one should have had his mind disquieted on the subject of usury, when such accommodating answers could be obtained. Far more distinct and candid was the reply of the President of the English (Roman Catholic) College of Douai, who, being questioned as to the opinion of his community upon the lawfulness of taking interest, answered ingenuously, they were divided; for such as had money to put out thought it lawful, such as had none were against it.

In the case forwarded to Rome, we may be certain the missionaries were not disposed to undervalue the risks to the lender: that they were unable to cite any but those inevitably attendant upon such transactions, even in highly-civilised and well-ordered communities, is satisfactory evidence of the general state of security in China at the time. Such being the fact, the very high rate of 30 per cent. per annum shows the amount of accumulated capital in the country to have been exceedingly small, when compared with the extent of the population and the supply of labour; and this state of things has continued: for we are told by a writer remarkably well informed upon the subject (Sir John Barrow), that, up to a recent period, the legal rate of interest was 3 per cent. for a month, or 36 per cent. per annum. The same writer mentions a regulation, which some persons may consider a wholesome one—that the borrower, if the interest be not punctually paid, is subjected to ten stripes of the bamboo for the first month, twenty for the second, and so on.[2] No information as to the rates of interest in China is to be found in the elaborate work of Du Halde upon that country; but the facts he states, as to the small sum required for obtaining a subsistence by traffic,[3] confirm the opinion above expressed of the general scarcity of capital. At present, the ordinary rate of interest in the kingdom of Siam is 30 per cent. per annum.[4] It is related by Du Halde that the mandarins commonly lent their money to the merchants.[3] And the Eastern nations generally, with the exception of the followers of Mahomet, appear to have had no scruples on the subject of usury. His denunciation of the practice, most probably suggested by the Mosaic law, is curious in one respect; for the justification of it he especially

[1] This case, with the decision thereon, extracted from the Epistles of Père Daniel (Paris, 1697), was given as a postscript to a pamphlet published in London (A.D. 1698), of which I have only seen a fragment.

[2] *Ency. Brit.*, 7th edit.; art., "China," p. 583.

[3] ii. 204.

[4] Sir John Bowring's *Account of Siam*, i. 406.

objects to, which was evidently the popular one at the time—"Truly, selling is but as usury"—is only a concise statement of the principle it has taken centuries of discussion to establish in this country—namely, that there are no grounds for treating a loan of money differently from any other commercial transaction.[1]

The Hindoo code of Manu stigmatizes travelling with merchandise as an occupation fit only for those the twice-born despise, but describes lending at interest as a virtuous mode of subsistence, especially recommended to the third caste (Vaisyas, or husbandmen), although not available for Kohatriyas (soldiers) or Brahmans. A lender of money may take, in addition to his capital, an eightieth part of a hundred (1¼ per cent.) by the month (15 per cent. per annum), or even two in the hundred (24 per cent. per annum), by remembering the duty of a good man—"for by taking two in the hundred he becomes not a sinner for gain," says the code, which continues—"He may thus take in the direct order of the classes: two in the hundred (24 per cent. per annum) from a Brahman, three from a Soldier, four from a Vaisya, and five from a mechanic or Sudra, but never more at interest by the month."

The subject of loans and pledges is very elaborately treated in the code, and special instructions are given as to the insurance of goods in transit, either by land or water.[2]

The peculiar nature of the questions that arose out of the subject of usury brought it within the domain of moral as well as of economical science, and attracted to it the special attention of nearly every eminent English writer who has treated of both those branches of knowledge. Thus it came to be considered by Bacon, Selden, and Locke; by Hume, Adam Smith, and Paley; by Bentham, and by Whateley.

"Many," says Lord Bacon, "have made witty invectives against usury," "but few have spoken of usury usefully." An assertion that was perfectly accurate at the time the essay from which it is extracted was published (A.D. 1625),[3] as this appears to have been

[1] The following is the doctrine of Mahomet upon the subject, extracted from the second chapter of the Koran, entitled The Cow. "They who devour usury shall not arise from the dead, but as he ariseth whom Satan has infected by a touch (*i. e.*, like demoniacs or possessed persons), this shall happen to them, because they say *Truly, selling is but as usury;* and yet God hath permitted selling and forbidden usury. He therefore who, when there cometh unto him an admonition from his Lord, abstaineth from usury for the future, shall have what is past forgiven him, and his affair belongeth unto God. But whoever returneth unto usury, they shall be the companions of hell fire, they shall continue therein for ever. God shall take his blessing from usury and shall increase alms." Sale's *Koran*, p. 52.

[2] Mrs. Spier's *Life in Ancient India:* Lond. 1856; pp. 162, 163.

[3] The *Essay of Usury* did not appear until the ninth edition of Bacon's essays, published the year before his death.—*See* Montague's *Life of Bacon*, Appendix, note 3, i.

the first attempt made in England to discuss the practice upon grounds purely political and social, and to consider calmly in what respect it was advantageous or otherwise to the community. The illustrious author, after enumerating some of the popular objections, continues, "It is good to set before us the incommodities as well as the commodities of usury." Among the former he instances, "that it makes fewer merchants; that it makes poor merchants; the third is incident to the other two, and that is, the decay of customs (revenue) of kings or estates, which ebb and flow with merchandising; the fourth, that it bringeth the treasure of a realm or state into few hands; the fifth, that it beats down the price of land; the sixth, that it doth dull and damp all industries, improvements, and new inventions, wherein money would be stirring were it not for this slug; the last, that it is the canker and ruin of many men's estates, which, in process of time, breeds a public poverty."

On the other hand, he enumerates among the commodities of usury, "that though in some respects it hindereth merchandising, yet, in some other, it advanceth it; for it is certain that the greatest part of trade is driven by young merchants upon borrowing at interest, so as if the usurer either call in or keep back his money, there will come presently a great stand in trade; the second is, that were it not for this easy borrowing upon interest, men's necessities would draw them upon a more sudden undoing, in that they would be forced to sell their means (be it lands or goods) far under foot; and so whereas usury does but gnaw upon them, bad markets would swallow them quite up. The third and last is, that it is a vanity to conceive that there would be ordinary borrowing without profit, and it is impossible to conceive the number of inconveniences that would ensue if borrowing be cramped; therefore, to speak of the abolishing of usury is idle; all states have had it in one kind or rate or other, so as that opinion must be sent to Utopia."

He then proposes, for the reformation and reglement of usury, a system in some respects analogous to the regulations of Justinian, which have been quoted.[1] First, that it should be reduced in general to five in the hundred, eight being then the legal rate; and secondly, that licences should be granted to certain persons to lend to "known merchants" at a higher rate, which was also to be limited, but to what extent is not stated. The licensed lenders not be restricted as to number, but to be confined to

[1] *Assurance Mag.* vi. 315.

certain principal cities and towns of merchandising, that they might not be able to colour (*i.e.*, pass for their own) other men's moneys.

I have given, in considerable detail, the views of Bacon as to usury, because I think nothing can show more strongly the thick mist of prejudice by which the subject was surrounded, than the fact, that one of the most sagacious and penetrating minds the world has produced, held opinions respecting it, which, if uttered at the present time, would be received with general ridicule.[1]

We might be tempted to suppose, that he had a clearer insight into the truth, but was deterred, by the fear of popular clamour, from expressing his full convictions, had he not, in his *Essay of Riches*, disclosed even narrower views, uttering therein, as his own, and without any qualification, opinions, which it might be inferred from the *Essay of Usury* that he considered popular errors. "Usury," he says, "is the certainest means of gain, though one of the worst, as that whereby a man doth eat his bread *in sudore vultus alieni*, and besides doth plough on Sundays."

That "the usurer's plough goes on Sundays" was a vulgar objection, which might as readily have been urged against all annual rents and charges, while the reproach of subsisting upon the labour of others applied with equal justice to all who lived upon accumulated property.

When speaking of the difficulties experienced by persons unable to borrow at interest, Bacon says, "As for mortgaging or pawning, it will little mend the matter; for, either men will not take pawns without use (*i.e.* interest), or, if they do, will look precisely to the forfeiture. I remember a cruel monied man in the country, that would say, 'The devil take this usury, it keeps us from forfeiture of mortgages and bonds.'"

The term mortgage is derived from *mortuum vadium*, or dead pledge, as distinguished from *vivum vadium*, or living pledge, by which an estate charged with a loan remained only in the hands of the lender until the rents and profits amounted to a sum sufficient to discharge the debt. When interest could not be received, a lender had no inducement to enter into such a transaction, because he could never obtain by it more than the return of his advance, without any profit; but it was otherwise with the *mortuum vadium*, by which he entered into possession of the estate, charged and

[1] "In this essay on usury, he does not go the whole length of the prejudices existing in his time, though he partakes of them in a great degree."—Whateley's *Annotations on Bacon's Essays*: London, 1856.

retained it in perpetuity, if the borrower neglected to repay the loan at the time appointed.[1]

In England, the distinction between these two kinds of security has been nearly obliterated by the *equity of redemption*, reserved to the borrower by the Courts of Equity; but it seems probable that the system under which land is generally charged with the payment of interest, originated in the refusal of the law to sanction lending upon interest in any form.

The inconveniences and losses inflicted by this refusal upon those whose necessities compelled them to borrow, are indicated by the regrets of the covetous Dives mentioned by Bacon, and will be readily understood by any one in the slightest degree conversant with the aspects presented by human nature in pecuniary transactions.

Bacon's complaint, that usury beats down the price of land, was a common cry at the time. Eleven years before the publication of his essay, on the 31st May, 1614, the following expressions are reported to have been used by a member of the House of Commons, in a debate upon a "Bill against Usury and Scrivener Brokers," "that this usury maketh money leave merchandising, where £100 bringeth more profit to the king than £100,000 at interest; hindereth the king on his subsidies; is a great scandal to our religion; taketh away a principal part of liberality; hath filled full the prisons; *enhanceth all the commodities of the kingdom; abaseth the price of lands.*[2]"

The failure of the orator quoted to perceive that he who lends upon an estate helps to keep it out of the market, and thus to keep up its price, will, perhaps, excite less surprise, as the discovery appears to have partially eluded the sagacity of Bacon; but it is certainly marvellous any one should have imagined that usury could diminish the price of land, and, at the same time, enhance the price of those products that alone render it valuable.

If the signal practical refutation such opinions were fated to receive could have been revealed to those who held them, the astonishment of the theorists would have been unbounded.

We cannot fix with perfect accuracy the value of land in the time of Bacon, but we have the means of making an approximate calculation upon the subject.

It is mentioned by Hume, that in the year 1544, an acre of good land let for a shilling, which he estimates at fifteen pence of our present money.[3] It is difficult to assign a precise equivalent

[1] Blackstone's *Commentaries*, book ii., chap. x.
[2] *Commons' Journals* i. 303.
[3] *Hist. Eng.*, chap. xxxiii.

to the shilling of Henry the Eighth's time, as he caused coins of this denomination to be struck of very different intrinsic values; but, during the greater part of his reign, the shilling appears to have been about equal to eighteen pence in our modern currency: and this is the proportion adopted by Adam Smith.[1] Towards the end of the seventeenth century, rent in England was about six shillings the acre;[2] and as the average in 1843 was not less than twenty-four shillings the acre,[3] Lord Macaulay is correct in his estimate that it had quadrupled in the interval between the two periods[4]—about a century and a half. It had increased, as we have seen, in exactly the same proportion during the nearly similar interval preceding the Revolution; so that, assuming the growth to have been uniform, the annual value of land in England has been doubled once in every period of seventy-five years since the Reformation, being an increase in each year of 0·934, or 18*s.* 8*d.*, per cent.

An improvement of less than 1 per cent. per annum, does not sound very remarkable; but, nevertheless, should the same rate of increase continue for as long a period as it has already been in progress, the annual value of an acre of land in England three hundred years hence will be nearly £20 sterling; the revenues of some existing entails, if they can be maintained unbroken, will be reckoned by millions; and the rental, for a single year, of the whole landed property of the United Kingdom, will exceed the present amount of our National Debt.[5] What sum the latter will have attained to by the period in question, I shall not pretend to conjecture. The sober processes of arithmetic occasionally outstrip the wildest flights of imagination. Perhaps the poet who sang—

"The grand agrarian alchemy—high rent,"[6]

would never have dreamed of such a development of it as is here

[1] Book i., chap. i., conclusion.

[2] *Usury, &c., examined by T. Morley:* Lond. 1662; p. 11.

[3] In McCulloch's *Statistical Account of the British Empire* (vol. i., p. 553), the average rent of land, in 1843, is given for England only at £1. 3*s.* 2½*d.* per statute acre; but as this result is obtained by dividing the gross rental of the kingdom by the aggregate acreage of the counties, without allowance for roads and wastes, the actual average must be somewhat higher.

[4] *Hist. Eng.* i. 318.

[5] The total rental of England and Wales is estimated to have been—

In 1600, £6,000,000	By Davenant, vol. i., page 362 (*including houses and mines*).
1680, £14,000,000	
1771, £16,000,000	By Arthur Young: *Northern Tour* iv. 366 (land only).
1806, £25,000,000	By McCulloch: *Statistical Account of the British Empire* i. 558 (land only). These numbers having been deduced from the property-tax returns, are probably correct; the accuracy of the others is necessarily very doubtful.
1815, £34,230,000	
1843, £40,167,000	
1852, £41,118,000	

[6] Byron: *Age of Bronze.*

suggested, and yet nothing has been supposed but a repetition of results that have actually occurred.

"When interest was at 10 per cent," says Adam Smith, "land sold commonly for ten and twelve years' purchase."[1] He does not give any authority for this assertion, which seems rather to be founded upon a principle laid down by himself, that "The ordinary market price of land depends everywhere upon the ordinary market rate of interest."[2] In reference to this, it may be remarked that, although there must always be a relative proportion between them, the extent of it may be materially modified by circumstances.

It seems certain that the odium attending loans upon interest, at the period under consideration, would have deterred most capitalists from engaging in them, unless tempted by a much higher profit than could be made by the purchase of land; yet the greatest difference assigned by Adam Smith is not more than exists at the present day, when the rate of interest upon mortgages always exceeds, by at least a sixth part, and often in a greater proportion, the returns upon landed investments.

Dr. Davenant, according to Lord Macaulay, "an acute and well informed, though most unprincipled and rancorous, politician,"[3] says land sold at twelve years' purchase "before England became a trading nation,"[4] a description that hardly applies to the age of Drake and Raleigh. One of the reasons urged by Bacon for the reduction of interest to 5 per cent., was, that it would keep up the price of land; because, at sixteen years' purchase, which he appears to have considered as beyond the common rate, though not excessively so,[5] it would pay more than 6 per cent.

Sir Thomas Culpeper the elder, perhaps the very best authority, spoke (A.D. 1621) of fifteen years' purchase as not likely to be exceeded.[6]

Upon the whole, it seems probable that, in the reign of James I., the value of land was from twelve to fourteen years' purchase; and as, according to the scale of progression that has been laid down, the rent would be about 3*s.* per acre, the selling price averaged from 36*s.* to 42*s.* per acre, not much more than a twentieth part of what, even without any peculiar advantage of situation, is commonly realized at the present time. As the relative improvement must have been greatest in the manufacturing districts, we may

[1] *W. of Nations*, book ii., chap. iv. [2] *Ibid.* [3] *Hist. Eng.* i. 314.
[4] Works: Lond. 1771; i. 359. [5] *Essay of Usury.*
[6] *See* his Tract *Against Usury.*

readily believe the assertion—that the present amount of the yearly rental of Lancashire would have bought the fee simple of the county in the time of Elizabeth.

It is undoubted that this increase could never have taken place if the total prohibition of usury had continued to exist.

(End of Part II.)

On the Calculus of Finite Differences, and its Application to Problems in the Doctrine of Compound Interest and Certain Annuities. By Wm. Curtis Otter, F.R.A.S.

THE calculus of finite differences was created by Taylor, in his celebrated work entitled *Methodus Incrementorum*, and it consists, essentially, in the consideration of the finite increments which functions receive as a consequence of analogous increments on the part of the corresponding variables. These increments or differences, which take the characteristic Δ to distinguish them from differentials, or infinitely small increments, may be in their turn regarded as new functions, and become the subject of a second similar consideration, and so on; from which results the notion of differences of various successive orders, analogous at least in appearance to the consecutive orders of differentials. Such a calculus evidently presents, like the calculus of indirect functions, two general classes of questions:—

1. *To determine the successive differences of all the various analytical functions of one or more variables, as the result of a definite manner of increase of the independent variables, which are generally supposed to augment in arithmetical progression.*

2. *Reciprocally to start from these differences, or, more generally, from any equation established between them, and go back to the primitive functions themselves or to their corresponding relations.*

Hence follows the decomposition of this powerful calculus into two distinct ones, to which are usually given the names of the *direct* and *inverse* calculus of finite differences, the latter being also sometimes called the integral calculus of finite differences.

The differences of this calculus are, by their nature, functions essentially similar to those which have produced them, a circumstance which renders them unsuitable to facilitate the establishment of equations, and prevents their leading to more general relations. Every equation of finite differences is truly, at bottom, an equation